UNCLASSIFIED

Defense Technical Information Center Compilation Part Notice

ADP010711

TITLE: F-5 Wing & F-5 Wing + TIP Store

DISTRIBUTION: Approved for public release, distribution unlimited

This paper is part of the following report:

TITLE: Verification and Validation Data for Computational Unsteady Aerodynamics [Donnees de verification et de valadation pour l'aerodynamique instationnaire numerique]

To order the complete compilation report, use: ADA390566

The component part is provided here to allow users access to individually authored sections of proceedings, annals, symposia, ect. However, the component should be considered within the context of the overall compilation report and not as a stand-alone technical report.

The following component part numbers comprise the compilation report:
ADP010704 thru ADP010735

UNCLASSIFIED

5E. F-5 WING & F-5 WING + TIP STORE

Evert G.M. Geurts
National Aerospace Laboratory NLR, The Netherlands

INTRODUCTION

This data set relates to a transonic wind tunnel investigation carried out in 1977 on an oscillating, slightly modified model of the outer part of a Northrop F-5 wing with and without an external store. The store represented an AIM-9J missile including its launcher. These tests were reported in references 1, 2 and 3. The model proceeded from an F-5 wing model for subsonic tests by a slight reduction of the model span, needed to accommodate the tip store considered in the document. In streamwise direction the wing possesses a modified NACA 65-A-004.8 airfoil, characterised by a droopnose, extending from the leading edge towards the point of maximum thickness at 40 per cent of the chord.

The aim of the experiments was to determine the unsteady aerodynamic loads on a representative fighter type wing in the transonic and low supersonic speed regimes. Detailed steady and unsteady pressure distributions were measured over the wing, while on the store strain gauge balances obtained aerodynamic loads (Ref. 4). To study the effect of the external store on the unsteady wing loading (interference effects) as well as the unsteady loads on the store itself and its components, the model was tested in various stages of completeness. Starting with the clean wing, successively more parts of the store (launcher, missile body, aft wings, canard fins) were added. Data presented here refer accordingly to the F-5 clean wing configuration, growing in steps to the configuration of the F-5 wing with complete tip store. The model geometry described in the Formulary concerns only the clean wing; geometry data concerning the tip store are not described in this document. However, they are presented in the figures and they are contained in the database on the CD-ROM, accompanying this chapter. Simultaneously with these measurements also wind tunnel wall pressures were recorded to support wall interference effect studies. In the same test also various stages of an underwing missile were measured (pylon, launcher, missile body with aft wings, complete missile). However, no underwing missile data are included in this document.

Subsonic tests on the unmodified wing model in different tip store and underwing configurations were extensively reported in references 5 and 6. Tests on the same wing but with an inboard control surface were reported in reference 7.

The tests on the F-5 wing and F-5 wing with tip store were carried out in the High Speed Tunnel of the National Aerospace Laboratory NLR, in Amsterdam, The Netherlands. The tests covered the Mach number range between Ma = 0.6 and Ma = 1.35, and frequencies up to 40 Hz. An overview of the selected data is given in table 1. For steady measurements steady values are presented; for unsteady measurements mean values are represented as well as real and imaginary part of the unsteady values.

LIST OF SYMBOLS AND DEFINITIONS

Definition of axes systems

Figure 1 shows the body-fixed co-ordinate system used for non-dimensionalisation.

Figure 2 shows the body-fixed axis system (CATIA origin)

x-axis: chordwise co-ordinate in wing reference plane: apex: $x = 0$

y-axis: spanwise co-ordinate in wing reference plane; y-axis = rotation axis or pitching axis at $x/C_r = 50.00$ %

z-axis: co-ordinate in plane of symmetry normal to wing reference plane

Definitions of pressure, force and moment coefficients for the wing

Steady and mean

Pressure coefficient $C_p = (P_{loc} - P) / Q$

Sectional normal force $C_z = Z / (Q * C) = - \int_0^1 (C_{p+} - C_{p-})\, d(x/C)$

Sectional pitching moment about quarter-chord point (positive nose down) $C_m = M / (Q * C^2) = - \int_0^1 (C_{p+} - C_{p-})\,(x/C - 0.25)\, d(x/C)$

Unsteady

Pressure coefficient $C_{pi} = \mathrm{Re}\, C_{pi} + i\, \mathrm{Im}\, C_{pi} = P_i / (Q * \theta)$

Sectional normal force	$C_{zi} = \mathrm{Re}\, C_{zi} + i\, \mathrm{Im}\, C_{zi} = Z_i / (\pi Q C \theta) = (1/\pi) \int_0^1 (C_{pi-} - C_{pi+})\, d(x/C)$
Sectional pitching moment about quarter-chord point (positive nose down)	$C_{mi} = \mathrm{Re}\, C_{mi} + i\, \mathrm{Im}\, C_{mi} = M_i / (½\pi Q C^2 \theta) = (2/\pi) \int_0^1 (C_{pi-} - C_{pi+})(x/C - 0.25)\, d(x/C)$

Quasi-Steady at zero incidence ($\omega = 0$; $\alpha_0 = 0$)

Pressure coefficient	$C_{pq} = \Delta C_p / \Delta\alpha = \{C_p(\alpha_0 + \Delta\alpha_1) - C_p(\alpha_0 - \Delta\alpha_2)\} / \{\Delta\alpha_1 + \Delta\alpha_2\}$
Sectional normal force	$C_{zq} = Z_q / (\pi Q C \theta) = \{C_z(\alpha_0 + \Delta\alpha_1) - C_z(\alpha_0 - \Delta\alpha_2)\} / \pi \{\Delta\alpha_1 + \Delta\alpha_2\}$
Sectional pitching moment (positive nose down)	$C_{mq} = M_q / (½\pi Q C^2 \theta) = 2\{C_m(\alpha_0 + \Delta\alpha_1) - C_m(\alpha_0 - \Delta\alpha_2)\} / \pi \{\Delta\alpha_1 + \Delta\alpha_2\}$

Definitions of force and moment coefficients of pylon and store

Steady and mean

Normal force	$C_z = Z / (Q * \bar{c} * S)$
Side force	$C_y = Y / (Q * \bar{c} * S)$
Pitching moment about balance centre (positive nose up)	$C_m = M / (Q * \bar{c}^2 * S)$
Yawing moment about balance centre (positive nose inward)	$C_n = N / (Q * \bar{c}^2 * S)$

Unsteady

Normal force	$C_{zi} = \mathrm{Re}\, C_{zi} + i\, \mathrm{Im}\, C_{zi} = Z_i / (\pi Q \bar{c} S \theta)$
Side force	$C_{yi} = \mathrm{Re}\, C_{yi} + i\, \mathrm{Im}\, C_{yi} = Y_i / (\pi Q \bar{c} S \theta)$
Pitching moment about balance centre (positive nose up)	$C_{mi} = \mathrm{Re}\, C_{mi} + i\, \mathrm{Im}\, C_{mi} = M_i / (½\pi Q \bar{c}^2 S \theta)$
Yawing moment about balance centre (positive nose inward)	$C_{ni} = \mathrm{Re}\, C_{ni} + i\, \mathrm{Im}\, C_{ni} = N_i / (½\pi Q \bar{c}^2 S \theta)$

Quasi-Steady at zero incidence ($\omega = 0$; $\alpha_0 = 0$)

Normal force	$C_{zq} = Z_i / (\pi Q \bar{c} S \theta) = \{C_z(\alpha_0 + \Delta\alpha_1) - C_z(\alpha_0 - \Delta\alpha_2)\} / \pi \{\Delta\alpha_1 + \Delta\alpha_2\}$
Side force	$C_{yq} = Y_i / (\pi Q \bar{c} S \theta) = \{C_y(\alpha_0 + \Delta\alpha_1) - C_y(\alpha_0 - \Delta\alpha_2)\} / \pi \{\Delta\alpha_1 + \Delta\alpha_2\}$
Pitching moment about balance centre (positive nose up)	$C_{mq} = M_i / (½\pi Q \bar{c}^2 \theta) = 2\{C_m(\alpha_0 + \Delta\alpha_1) - C_m(\alpha_0 - \Delta\alpha_2)\} / \pi \{\Delta\alpha_1 + \Delta\alpha_2\}$
Yawing moment about balance centre (positive nose inward)	$C_{nq} = N_i / (½\pi Q \bar{c}^2 \theta) = 2\{C_n(\alpha_0 + \Delta\alpha_1) - C_n(\alpha_0 - \Delta\alpha_2)\} / \pi \{\Delta\alpha_1 + \Delta\alpha_2\}$

Symbols

ALPHA, alpha, α	(°)	incidence, positive nose up
C	(m)	local chord
C	(-)	coefficient (followed by symbol or subscript)
C_r	(m)	root chord: $C_r = 0.6396$ m
$\bar{c}$	(m)	mean geometric chord: $\bar{c} = 0.4183$ m
F	(Hz)	frequency, frequency of model oscillation

K	(-)	reduced frequency, $K = \pi * F * C_r / V$
Ma, MA	(-)	freestream Mach number
M	(Nm)	pitching moment
N	(N)	wing normal force
P	(Pa)	freestream static pressure
P_0, P0	(Pa)	stagnation pressure
P_{loc}, PLOC	(Pa)	local static pressure
P_i	(Pa)	unsteady pressure at model surface
PPL	(Pa)	settling chamber pressure
Q	(Pa)	dynamic pressure
Re, RE	(-)	Reynolds number (x 10^{-6}) based on $\bar{c}$
S	(m)	semi-span: S = 0.6226 m
t	(s)	time
T0	(° C)	stagnation temperature
THETA, theta, θ	(°, rad)	amplitude of oscillation in section of accelerometers 1 and 2; positive nose up
V	(m/s)	freestream velocity
x	(m)	chordwise ordinate (see Definitions)
y	(m)	spanwise ordinate (see Definitions)
Y	(N)	side force
z	(m)	co-ordinate in plane of symmetry normal to WRP (see Definitions)
Z	(N)	normal force
α, ALPHA, alpha	(°)	incidence; positive nose up
θ, THETA, theta	(°, rad)	amplitude of oscillation in the section of accelerometers 1 and 2; positive nose up
ω	(rad/s)	angular velocity; $\omega = 2\pi * F$

Subscripts

I, i	referring to unsteady quantities
Q, q	referring to quasi-steady quantities

Suffices

+	denotes upper surface
-	denotes lower surface

Abbreviations

LVDT	Linear Variable Displacement Transducer
RE, Re	real part of complex number
IM, Im	imaginary part of complex number
WRP	Wing Reference Plane (Definition: Figure 1)

FORMULARY

1 General Description of model

1.1	Designation	F5 wing + store
1.2	Type	Semi-span model with modified NACA 65-A-004.8 airfoil
1.3	Derivation	Fighter-type wing
1.4	Additional remarks	AIM-9J launcher/missile
1.5	References	-

2 Model Geometry

2.1	Planform	Trapezoidal (swept tapered)
2.2	Aspect ratio	2.977
2.3	Leading edge sweep	31.917° (31°55')
2.4	Trailing edge sweep	5.033° (5°2')
2.5	Taper ratio	0.308
2.6	Twist	-
2.7	Root chord	0.6396
2.8	Semi-span of model	0.6226 (fairing excluded)
2.9	Area of planform	0.2604
2.10	Leading edge flap	-
2.11	Trailing edge flap	-
2.12	Reference locations and profile definitions	NACA 65-A-004.8 up to 40%, further backwards symmetrical (co-ordinates included in database in file "f5w.crd")
2.13	Form of wing body- or wing-root junction	No body
2.14	Form of wing tip	Fairing for clean wing, co-ordinates at 4 sections, See Table 2; see Figure 1
2.15	Additional remarks	Geometry data of all configurations are included as CATIA files in the database on CD-ROM
2.16	References	-

3 Wind Tunnel

3.1	Designation	NLR High Speed Tunnel (HST)
3.2	Type of tunnel	Continuous, variable pressure
3.3	Test section dimensions	Height: 1.6 m, width: 2.0 m, enclosed in large plenum chamber
3.4	Type of roof and floor	Slotted, 6 slots per wall
3.5	Type of side walls	Solid
3.6	Ventilation geometry	Roof and floor: open ratio 12%
3.7	Displacement thickness of side wall boundary layer	~ 7 mm
3.8	Thickness of boundary layers at roof and floor	Not measured
3.9	Method of measuring Mach number	Derived from settling chamber stagnation and plenum chamber static pressures
3.10	Flow angularity	< 0.1° in centre of test section, less than 0.25° elsewhere
3.11	Uniformity of Mach number over test section	< 0.4% in $\Delta M/M$ at supersonic Mach numbers
3.12	Sources and levels of noise or turbulence in empty tunnel	< 1% in rms p/q for M=0.8

3.13	Tunnel resonance	No evidence of resonance
3.14	Additional remarks	Information on flow angularity and Mach number uniformity available only along test section centreline
3.15	References on tunnel	Ref. 8.

4 Model motion

4.1	General description	Sinusoidal pitching about axis normal to wind tunnel side wall. Axis location at 50% root chord
4.2	Reference co-ordinate and definition of motion	Oscillation amplitude measured with LVDT on actuator
4.3	Range of amplitude	Between 0.1° and 0.5°.
4.4	Range of frequency	10, 20, 30 and 40 Hz
4.5	Method of applying motion	Electro-hydraulic shaker system (HYDRA), see Ref.10
4.6	Timewise purity of motion	Adequate purity of sinusoid
4.7	Natural frequencies and normal modes of model	Not traceable, but far enough from driving frequencies
4.8	Method of applying motion	Actual modes measured with accelerometers: Wing 8, store 4 (position and output of accelerometers included in database files)
4.9	Additional remarks	-

5 Test Conditions

5.1	Model planform area/tunnel area	0.0814
5.2	Model span/tunnel width	0.3113
5.3	Blockage	Negligible
5.4	Position of model in tunnel	Standard sidewall position
5.5	Range of Mach number	0.6 to 1.35
5.6	Range of tunnel total pressure	70 kPa and 100 kPa
5.7	Range of tunnel total temperature	Total temperature included in data point information
5.8	Range of model steady or mean incidence	-0.5°, 0.0°, +0.5°
5.9	Definition of model incidence	Relative to line of symmetry of rear part
5.10	Position of transition, if free	Not measured
5.11	Position and type of trip, if transition fixed	No transition trips
5.12	Flow instabilities during tests	None encountered
5.13	Changes to mean shape of model due to steady aerodynamic load	Not measured
5.14	Additional remarks	-
5.15	References describing tests	References 1 and 2

6 Measurements and Observations

6.1	Steady pressures for the mean conditions	Wing	Yes
		Slotted top wall	Yes
6.2	Steady pressures for small changes from the mean conditions	Wing	Yes
6.3	Quasi-steady pressures	Wing	Yes
6.4	Unsteady pressures	Wing	Yes
		Slotted top wall	Yes
6.5	Steady forces for the mean conditions	Store: measured directly	Yes
		Wing: Integrated pressures	Yes
6.6	Steady forces for small changes from the	Store: measured directly	Yes

	mean conditions		
		Wing: Integrated pressures	Yes
6.7	Quasi-steady forces	Store: measured directly	Yes
		Wing: Integrated pressures	Yes
6.8	Unsteady forces	Store: measured directly	Yes
		Wing: Integrated pressures	Yes
6.9	Measurement of actual motion at points of model		Yes
6.10	Observation or measurement of boundary layer properties		No
6.11	Visualisation of (surface) flow		No
6.12	Visualisation of shock wave movements		No
6.13	Additional remarks	-	

7 Instrumentation

7.1	Steady pressure	
	7.1.1 Position of orifices spanwise and chordwise	8 spanwise sections, 10 upper and 10 lower, see Figure 1 and CD-ROM file "sensors.txt"
	7.1.2 Type of measuring system	PHAROS (Ref.9): combination of 160 orifices and connecting tubes and 8 miniature pressure transducers
7.2	Unsteady pressure	
	7.2.1 Position of orifices spanwise and chordwise	See Figure 1 and CD-ROM file "sensors.txt"
	7.2.2 Diameter of orifices	0.8 mm
	7.2.3 Type of measuring system	PHAROS (Ref.9)
	7.2.4 Type of transducers	Scanning valves: Statham. In situ transducers: Kulite and Endevco
	7.2.5 Principle and accuracy of calibration	Data acquisition system was calibrated daily, pressure transducers before and after wind tunnel test. Accuracy less/equal 1%
7.3	Model motion	
	7.3.1 Method of measuring motion reference co-ordinate	LVDT: Sangamo
	7.3.2 Method of determining spatial mode of motion	8 accelerometers on wing, 4 accelerometers on store
	7.3.3 Accuracy of measured motion	Accelerometers: about 1%, LVDT: better than 0.015 mm
7.4	Processing of unsteady measurements	
	7.4.1 Method of acquiring and processing measurements	Direct Fourier Transform of time signals to harmonic components
	7.4.2 Type of analysis	Averaging and determination of first (and higher) harmonics took place over signal lengths of 1 s (steady), or about 1 s with round-off to integral number of cycles (unsteady)
	7.4.3 Unsteady pressure quantities obtained and accuracies achieved	Fundamental harmonics and occasionally second and third harmonics for accuracy see 9.1.6
	7.4.4 Method of integration to obtain forces	Trapezoidal rule
7.5	Additional remarks	Position of accelerometers, see Figure 1 and CD-ROM
7.6	References on techniques	-

8 Data presentation

8.1	Test cases for which data could be made available	See Tables 3, 4 and 5
8.2	Test cases for which data are included in this document	See Table 1

8.3	Steady pressures	See Tables 3, 4 and 5
8.4	Quasi-steady or steady perturbation pressures	See Tables 3, 4 and 5
8.5	Unsteady pressures	See Tables 3, 4 and 5
8.6	Steady forces or moments	See Tables 3, 4 and 5; integrated pressures on wing, measured directly on store
8.7	Quasi-steady or unsteady perturbation forces	See Tables 3, 4 and 5; integrated pressures on wing, measured directly on store
8.8	Unsteady forces and moments	See Tables 3, 4 and 5; integrated pressures on wing, measured directly on store
8.9	Other forms in which data could be made available	-
8.10	Ref. giving other representations of data	Ref.1

9 Comments on data

9.1	Accuracy	
	9.1.1 Mach number	+/- 0.001
	9.1.2 Steady incidence	+/- 0.01° at LVDT position
	9.1.3 Reduced frequency	+/- 0.0005
	9.1.4 Steady pressure coefficients	+/- 0.5 percent
	9.1.5 Steady pressure derivatives	-
	9.1.6 Unsteady pressure coefficients	Uncertainty in the real and imaginary parts of the coefficients is probably +/- (0.02 + 0.05 Q), where Q = |R| or |I|
9.2	Sensitivity to small changes of parameter	-
9.3	Non-linearity's	-
9.4	Influence of tunnel total pressure	-
9.5	Effects on data of uncertainty, or variation, in mode of model motion	-
9.6	Wall interference corrections	Unsteady wall pressures measured, no correction applied
9.7	Other relevant tests on same model	References 5 and 6: Same wing, F5 + tip-tank and store (Data possibly not available) Reference 7: Same wing, F5 + inboard flap
9.8	Relevant tests on other models of nominally the same shapes	See above
9.9	Any remarks relevant to comparison between experiment and theory	This publication, Chapter 4
9.10	Additional remarks	An example of a database file is included in table 6. Structure of file set-up is included in README file in database.
9.11	References on discussion of data	-

10 Personal contact for further information

Evert G.M. Geurts
Department of Aerodynamic Engineering and Aeroelasticity
Phone: +31 20 5113455
Fax: +31 20 5113210
Email: geurts@nlr.nl

National Aerospace Laboratory NLR
Anthony Fokkerweg 2 P.O. Box 90502
NL 1059 CM Amsterdam NL 1006 BM Amsterdam
The Netherlands The Netherlands
Phone: +31 20 5113113
Fax: +31 20 5113210
Website: http://www.nlr.nl

11 List of references

1 van Nunen, J.W.G., Tijdeman, H., et.al., "Results of transonic wind tunnel measurements on an oscillating wing with external store (data report)", NLR TR 78030 U, 1978

2 Tijdeman, H., van Nunen, J.W.G. et.al., "Transonic Wind Tunnel Tests of an Oscillating Wing with External Store",

Part I: General description

Part II: The clean wing

Part III: The wing with tip store

Part IV: The wing with under wing-store

NLR TR 78106 U, 1978 (also AFFDL TR 78-194, 1978)

3 Roos, R., "Unsteady airloads on a harmonically pitching wing with external stores", Proceedings of the AIAA/ASME 21st Structures, Structural Dynamics and Materials Conference, Seattle, Washington, May 12-14, AIAA paper 80-733, 1980, (also NLR MP 80004 U, 1980

4 Persoon, A.J., "Measuring unsteady loads on wing-mounted stores", NLR TR 79013 U, 1979

5 Renirie, L., van Nunen, J.W.G. et.al., "Unsteady pressure measurements on a wing with stores in subsonic flow",

Part I: Description of tests,

Part II: Tabulated results,

NLR TR 75155C, 1975

6 Van Nunen, J.W.G., Roos, R., Meijer, J.J., "Investigation of the unsteady airloads on wing-store configurations in subsonic flow", AGARD CP227: Unsteady Aerodynamics, (also NLR MP 77025 U, 1977)

7 Persoon, A.J., Roos, R., Schippers, P., "Transonic and low supersonic wind tunnel tests on a wing with inboard control surface",

Part I: General description,

Part II: Tabulated results,

NLR TR 80070 L, 1980

8 NN., "Users guide to the High Speed Tunnel (HST): edition 1977

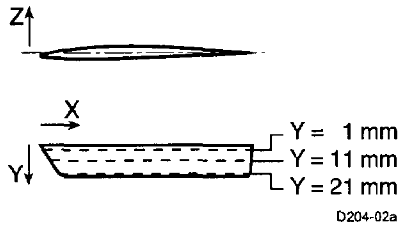
9 Fuykschot, P.H., "PHAROS, Processor for harmonic analysis of the response of oscillating surfaces", NLR MP 77012 U, 1977

10 Poestkoke, R., "Hydraulic test rig for oscillating wind-tunnel models", NLR MP 76020 U, 1976

Selected Steady Cases				Selected Unsteady Cases						
RUN	Ma	ALPHA	Re	RUN	Ma	K	ALPHA	Re	F	THETA
WING										
137	.597	-.005	4.77	383	.597	.399	.004	4.57	40.000	.115
138	.597	.493	4.77	370	.896	.275	.001	5.73	40.000	.111
151	.897	-.004	5.79	160	.947	.132	-.006	5.91	20.000	.523
152	.896	.497	5.79	373	1.092	.058	.003	5.92	10.000	.113
158	.946	-.004	5.89	172	1.093	.116	.003	6.02	20.000	.267
168	1.093	-.002	6.01	193	1.336	.198	-.001	4.10	40.000	.222
190	1.328	-.005	4.07							
191	1.327	.500	4.08							
WING WITH TIP LAUNCHER										
198	.597	-.004	4.73	204	.598	.402	-.007	4.80	40.000	.114
208	.897	-.009	5.94	211	.898	.276	.010	5.84	40.000	.224
218	1.329	-.256	4.27	222	1.323	.200	.000	4.24	40.000	.115
WING WITH TIP LAUNCHER + MISSILE BODY										
256	.597	.001	4.62	259	.593	.402	-.006	4.60	40.000	.221
251	.894	-.010	5.68	254	.894	.276	-.005	5.69	40.000	.223
234	1.327	-.004	4.21	237	1.327	.199	.003	4.25	40.000	.111
WING WITH TIP LAUNCHER + MISSILE BODY + AFT FINS										
286	.596	-.004	4.68	289	.597	.401	-.004	4.68	40.000	.220
281	.894	-.004	5.94	284	.894	.279	-.004	5.95	40.000	.222
265	1.315	-.003	4.27	268	1.321	.200	-.004	4.33	40.000	.220
WING WITH TIP LAUNCHER + MISSILE BODY + AFT FINS + CANARD FINS										
341	.596	.005	4.59	348	.595	.401	.004	4.62	40.000	.111
320	.897	-.000	5.65	352	.897	.069	-.002	5.73	10.000	.115
297	1.330	-.003	4.41	355	.896	.275	.004	5.73	40.000	.117
				302	1.327	.199	.016	4.20	40.000	.221

Table 1: Selected test cases

Remark:
For the different configurations tested, the steady normal force and pitching moment acting on the store were measured with a strain gage balance; the unsteady normal force and pitching moment were measured with the same balance. For test cases above 30 Hz doubts have been expressed concerning the store loads. For that reason all 40 Hz cases were omitted from the database files.



x mm	y mm
0.46	1.00
3.56	6.00
6.66	11.00
9.80	16.00
14.58	21.00
16.00	22.00
17.78	23.00
20.24	24.00
30.00	24.98
100.00	25.00
160.00	25.02
170.00	24.90
180.00	24.38
190.00	23.54
192.00	23.08
194.00	21.52
196.10	1.00

	y = 1.00 mm		y = 11.00 mm		y = 21.00 mm	
x mm	z_{upper} mm	z_{lower} mm	Z_{upper} mm	Z_{lower} mm	Z_{upper} mm	Z_{lower} mm
1	-1.58	-2.68				
5	-0.38	-3.18				
7			-1.66	-2.58		
10	0.56	-3.38	-0.58	-3.06		
15			0.42	-3.28	-1.54	-2.66
20	1.94	-3.68	1.18	-3.44	0.20	-3.20
25			1.80	-3.70	1.02	-3.38
30	2.86	-3.90			1.66	-3.50
40	3.56	-4.12	3.12	-3.90	2.64	-3.72
50	4.06	-4.32	3.70	-4.10	3.32	-3.92
60	4.38	-4.48	4.08	-4.28	3.78	-4.08
70	4.56	-4.60	4.34	-4.40	4.08	-4.22
80	4.62	-4.64	4.44	-4.48	4.24	-4.30
90	4.56	-4.64	4.43	-4.52	4.26	-4.36
100	4.46	-4.54	4.34	-4.44	4.18	-4.32
110	4.28	-4.36	4.18	-4.28	4.04	-4.18
120	4.00	-4.10	3.94	-4.02	3.80	-3.96
130	3.70	-3.76	3.62	-3.70	3.52	-3.66
140	3.30	-3.32	3.24	-3.28	3.14	-3.26
150	2.80	-2.80	2.76	-2.76	2.68	-2.74
160	2.24	-2.26	2.18	-2.20	2.12	-2.18
170	1.64	-1.68	1.59	-1.64	1.52	-1.60
180	1.02	-1.12	0.98	-1.08	0.90	-1.03
190	0.40	-0.54	0.40	-0.52	0.28	-0.46
194					0.00	-0.22
195	0.13	-0.19	0.04	-0.22		

Table 2: Co-ordinates of tip fairing of F-5 clean wing configuration

STEADY TESTS			
RUN	Ma	ALPHA	Re
136	0.598	-.504	4.76
137	0.597	-.005	4.77
138	0.597	0.493	4.77
145	0.799	-.508	5.63
146	0.796	-.004	5.63
147	0.797	0.493	5.54
150	0.899	-.504	5.78
151	0.897	-.004	5.79
152	0.896	0.497	5.79
157	0.949	-.511	5.89
158	0.946	-.004	5.89
159	0.946	0.496	5.90
162	1.046	-.506	6.04
163	1.044	-.004	6.04
164	1.044	0.494	6.06
167	1.096	-.512	6.00
168	1.093	-.002	6.01
169	1.093	0.498	6.02
184	1.184	-.506	4.28
185	1.185	-.005	4.25
186	1.186	0.495	4.26
189	1.333	-.504	4.12
190	1.328	-.005	4.07
191	1.327	0.500	4.08

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
380	0.596	0.100	0.003	4.57	10.000	0.108
382	0.598	0.199	0.004	4.57	20.000	0.106
381	0.597	0.299	0.005	4.57	30.000	0.110
383	0.597	0.399	0.004	4.57	40.000	0.115
367	0.800	0.153	0.004	5.48	20.000	0.108
368	0.796	0.307	0.001	5.47	40.000	0.113
378	0.899	0.068	0.001	5.65	10.000	0.108
369	0.899	0.137	0.002	5.73	20.000	0.109
379	0.896	0.206	0.002	5.66	30.000	0.108
370	0.896	0.275	0.001	5.73	40.000	0.111
160	0.947	0.132	-.006	5.91	20.000	0.523
161	0.948	0.264	-.013	5.92	40.000	0.222
375	0.996	0.125	0.005	5.79	20.000	0.107
376	0.994	0.250	0.000	5.80	40.000	0.112
165	1.045	0.122	-.003	6.07	20.000	0.522
166	1.044	0.243	0.004	6.08	40.000	0.219
373	1.092	0.058	0.003	5.92	10.000	0.113
172	1.093	0.116	0.003	6.02	20.000	0.267
374	1.092	0.173	0.004	5.92	30.000	0.110
372	1.093	0.231	-.000	5.92	40.000	0.112
187	1.188	0.109	-.010	4.28	20.000	0.524
188	1.186	0.218	-.008	4.29	40.000	0.222
192	1.328	0.100	-.008	4.09	20.000	0.523
193	1.336	0.198	-.001	4.10	40.000	0.222

Table 3: Test programme F-5 WING

STEADY TESTS			
RUN	Ma	ALPHA	Re
197	0.599	-.505	4.78
198	0.597	-.004	4.73
199	0.596	0.497	4.73
206	0.899	-.510	5.90
208	0.897	-.009	5.94
209	0.896	0.496	5.95
212	1.095	-.514	6.10
213	1.092	-.005	5.98
214	1.092	0.496	6.00
223	1.089	-.502	4.19
224	1.086	-.002	4.26
225	1.091	0.494	4.29
217	1.327	-.504	4.37
218	1.329	-.256	4.27
220	1.330	0.499	4.28

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
202	0.596	0.202	-.004	4.76	20.000	0.111
204	0.598	0.402	-.007	4.80	40.000	0.114
210	0.897	0.138	0.006	5.83	20.000	0.530
211	0.898	0.276	0.010	5.84	40.000	0.224
215	1.092	0.116	-.007	6.01	20.000	0.531
216	1.095	0.232	-.005	6.02	40.000	0.226
226	1.088	0.117	-.006	4.99	20.000	0.526
227	1.091	0.234	-.000	4.32	40.000	0.117
221	1.329	0.100	-.001	4.22	20.000	0.529
222	1.323	0.200	0.000	4.24	40.000	0.115

Table 4a: Test programme F-5 WING WITH TIP LAUNCHER

STEADY TESTS			
RUN	Ma	ALPHA	Re
255	0.592	-.512	4.56
256	0.597	0.001	4.62
257	0.594	0.495	4.60
249	0.897	-.512	5.61
251	0.894	-.010	5.68
252	0.893	0.498	5.68
244	1.092	-.512	5.91
245	1.089	-.001	5.91
246	1.089	0.497	5.92
233	1.324	-.508	4.50
234	1.327	-.004	4.21
235	1.327	0.499	4.23

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
258	0.595	0.201	-.001	4.60	20.000	0.524
259	0.593	0.402	-.006	4.60	40.000	0.221
253	0.895	0.138	-.008	5.69	20.000	0.532
254	0.894	0.276	-.005	5.69	40.000	0.223
247	1.090	0.116	-.003	5.92	20.000	0.530
248	1.089	0.232	0.001	5.93	40.000	0.230
242	1.086	0.116	-.008	4.19	20.000	0.525
243	1.085	0.233	-.003	4.20	40.000	0.223
236	1.322	0.100	-.004	4.24	20.000	0.532
237	1.327	0.199	0.003	4.25	40.000	0.111

Table 4b: Test programme F-5 WING WITH TIP LAUNCHER + MISSILE BODY

STEADY TESTS			
RUN	Ma	ALPHA	Re
285	0.592	-.509	4.67
286	0.596	-.004	4.68
287	0.596	0.497	4.68
280	0.896	-.508	5.62
281	0.894	-.004	5.94
282	0.894	0.494	5.94
274	1.089	-.508	6.03
275	1.089	-.002	5.91
276	1.089	0.492	5.93
269	1.086	-.511	4.13
270	1.082	-.006	4.22
271	1.084	0.498	4.23
264	1.319	-.505	4.29
265	1.315	-.003	4.27
266	1.315	0.496	4.29

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
288	0.598	0.201	-.009	4.70	20.000	0.525
289	0.597	0.401	-.004	4.68	40.000	0.220
283	0.896	0.139	-.007	5.95	20.000	0.534
284	0.894	0.279	-.004	5.95	40.000	0.222
277	1.089	0.116	-.009	5.93	20.000	0.522
278	1.090	0.232	-.006	5.92	40.000	0.226
272	1.084	0.117	-.008	4.23	20.000	0.524
273	1.087	0.234	-.003	4.26	40.000	0.113
267	1.319	0.100	-.006	4.32	20.000	0.527
268	1.321	0.200	-.004	4.33	40.000	0.220

Table 4c: Test programme F-5 WING WITH TIP LAUNCHER + MISSILE BODY + AFT FINS

STEADY TESTS			
RUN	Ma	ALPHA	Re
340	0.598	-.502	4.58
341	0.596	0.005	4.59
342	0.595	0.505	4.60
333	0.696	-.500	5.10
334	0.696	0.005	5.11
335	0.696	0.506	5.11
326	0.797	-.500	5.44
327	0.797	-.001	5.43
328	0.796	0.499	5.45
319	0.896	-.494	5.65
320	0.897	-.000	5.65
321	0.897	0.505	5.68
312	1.096	-.499	5.97
313	1.093	0.003	5.95
314	1.091	0.504	5.95
303	1.092	-.522	4.14
306	1.090	0.018	4.25
307	1.094	0.499	4.28
295	1.332	-.495	4.43
297	1.330	-.003	4.41
298	1.329	0.495	4.43

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
351	0.595	0.100	0.005	4.63	10.000	0.109
350	0.596	0.200	0.004	4.63	20.000	0.114
344	0.596	0.200	0.001	4.61	20.000	0.527
349	0.596	0.300	0.013	4.63	30.000	0.109
348	0.595	0.401	0.004	4.62	40.000	0.111
336	0.697	0.086	0.001	5.13	10.000	0.535
337	0.697	0.173	-.001	5.13	20.000	0.528
338	0.696	0.260	0.002	5.14	30.000	0.375
339	0.697	0.346	0.005	5.14	40.000	0.225
357	0.798	0.076	0.003	5.40	10.000	0.110
358	0.797	0.153	0.001	5.40	20.000	0.108
359	0.797	0.229	0.006	5.40	30.000	0.110
360	0.797	0.305	0.004	5.41	40.000	0.115
352	0.897	0.069	-.002	5.73	10.000	0.115
353	0.896	0.138	-.000	5.72	20.000	0.110
354	0.895	0.207	0.003	5.72	30.000	0.110
355	0.896	0.275	0.004	5.73	40.000	0.117
315	1.094	0.058	-.004	5.96	10.000	0.547
316	1.092	0.116	-.003	5.97	20.000	0.527
317	1.094	0.174	-.005	5.99	30.000	0.376
318	1.093	0.231	0.003	5.99	40.000	0.228
308	1.092	0.058	-.013	4.29	10.000	0.536
309	1.091	0.117	-.013	4.30	20.000	0.519
310	1.091	0.175	0.003	4.30	30.000	0.375
311	1.091	0.234	0.007	4.32	40.000	0.224
299	1.329	0.051	0.006	4.45	10.000	0.532
300	1.330	0.101	0.011	4.37	20.000	0.526
301	1.328	0.149	0.012	4.18	30.000	0.374
302	1.327	0.199	0.016	4.20	40.000	0.221

Table 4d: Test programme F-5 WING WITH TIP LAUNCHER + MISSILE BODY + AFT FINS + CANARD FINS

STEADY TESTS			
RUN	Ma	ALPHA	Re
125	0.598	-.507	4.47
126	0.595	-.001	4.58
127	0.596	0.496	4.58
120	0.897	-.499	5.54
121	0.898	0.000	5.59
122	0.897	0.499	5.59
116	1.094	-.504	5.96
117	1.094	-.003	5.96
118	1.094	0.496	5.97
106	1.092	-.505	4.13
107	1.089	-.002	4.24
108	1.089	0.502	4.25
101	1.333	-.503	4.53
102	1.331	-.001	4.19

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
128	0.599	0.199	-.003	4.60	20.000	0.526
129	0.597	0.399	0.002	4.58	40.000	0.223
123	0.898	0.137	-.003	5.60	20.000	0.529
124	0.898	0.273	-.001	5.60	40.000	0.221
114	1.095	0.115	-.004	5.94	20.000	0.532
115	1.094	0.231	-.003	5.95	40.000	0.220
109	1.090	0.117	-.009	4.26	20.000	0.524
110	1.093	0.233	-.001	4.28	40.000	0.223
104	1.331	0.099	-.002	4.20	20.000	0.528
105	1.331	0.199	-.001	4.21	40.000	0.223

Table 5a: Test programme F-5 WING WITH PYLON

STEADY TESTS			
RUN	Ma	ALPHA	Re
54	0.600	-.498	3.42
55	0.597	-.001	3.33
56	0.597	0.500	3.33
61	0.897	-.497	4.19
62	0.896	-.001	4.22
63	0.897	0.513	4.04
68	1.090	-.499	4.35
69	1.089	-.004	4.36
70	1.088	0.495	4.38
75	1.331	-.493	4.18
76	1.325	-.002	4.20
77	1.329	0.495	4.22

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
57	0.597	0.101	0.001	3.34	10.000	0.523
58	0.599	0.201	0.001	3.36	20.000	0.518
59	0.597	0.303	0.002	3.35	30.000	0.370
60	0.597	0.403	0.003	3.36	40.000	0.229
64	0.897	0.070	0.038	3.83	10.000	0.533
65	0.898	0.140	0.003	4.18	20.000	0.519
66	0.895	0.210	0.008	4.18	30.000	0.375
67	0.898	0.279	0.009	4.20	40.000	0.226
71	1.090	0.059	0.005	4.41	10.000	0.534
72	1.089	0.118	0.001	4.42	20.000	0.526
73	1.090	0.176	0.004	4.35	30.000	0.371
74	1.089	0.234	0.001	4.36	40.000	0.223
78	1.331	0.050	-.002	4.20	10.000	0.529
79	1.328	0.099	-.003	4.22	20.000	0.524
80	1.331	0.149	-.001	4.23	30.000	0.372
81	1.329	0.199	-.001	4.25	40.000	0.228

Table 5b: Test programme F-5 WING WITH PYLON + LAUNCHER

STEADY TESTS			
RUN	Ma	ALPHA	Re
40	0.598	-.500	4.75
41	0.596	-.002	4.75
42	0.598	0.498	4.74
45	0.899	-.501	5.80
46	0.898	-.018	5.81
47	0.898	0.498	2.54

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
43	0.597	0.201	0.001	4.71	20.000	0.527
44	0.599	0.400	-.001	4.67	40.000	0.230
48	0.898	0.138	0.001	5.79	20.000	0.524
49	0.897	0.081	0.006	0.36	40.000	0.225

Table 5c: Test programme F-5 WING WITH PYLON + LAUNCHER + MISSILE

STEADY TESTS			
RUN	Ma	ALPHA	Re
89	1.093	-.500	4.26
90	1.088	0.001	4.28
91	1.089	0.500	4.29
94	1.333	-.506	4.25
95	1.332	0.001	4.16
96	1.333	0.502	4.17

UNSTEADY TESTS						
RUN	Ma	K	ALPHA	Re	F	THETA
88	0.899	0.141	0.003	6.21	20.000	0.521
87	0.902	0.281	0.003	6.20	40.000	0.226
92	1.089	0.118	0.003	4.30	20.000	0.521
93	1.090	0.235	0.001	4.31	40.000	0.222
97	1.335	0.099	-.002	4.20	20.000	0.522
98	1.330	0.199	-.002	4.23	40.000	0.223

Table 5d: Test programme F-5 WING WITH PYLON + LAUNCHER + MISSILE WITHOUT CANARD FINS

NATIONAL AEROSPACE LABORATORY NLR
NLR TR78030 U

TABLE 1.1

RUN 383 10111977 NF-5 WING

TEST CONDITIONS		DISPLACEMENTS NR	MOD	ARG
MA =	.597	1	.897	-178.6
PO =	99458.	2	1.000	0.0
PPL =	78039.	3	.334	-172.6
Q =	19503.	4	1.041	-2.0
TO =	31.00	5	.254	-16.3
RE =	4.57	6	1.097	-3.9
K =	.399	7	.259	-23.8
F =	40.000	8	1.205	-5.3
ALPHA=	.004	9	0.000	0.0
THETA=	.115	10	0.000	0.0
		11	0.000	0.0
		12	0.000	0.0

FORCE AND MOMENT COEFFICIENTS		
STAT	INSTAT	
	RE	IM

WING

SEC NR	CZ	CZI RE	CZI IM	CM	CMI RE	CMI IM
1	-.017	.88	.58	.008	.021	.357
2	-.009	1.02	.54	.007	-.052	.357
3	-.009	1.19	.50	.008	-.036	.320
4	.000	1.16	.44	.008	-.093	.307
5	-.001	1.16	.48	.008	-.025	.257
6	.002	1.00	.46	.007	-.037	.217
7	.005	.92	.42	.007	-.053	.183
8	.011	.40	.33	.005	-.065	.130

	WINGSECTION 1 UPPERSIDE				WINGSECTION 1 LOWERSIDE				WINGSECTION 2 UPPERSIDE				WINGSECTION 2 LOWERSIDE			
X/C	MLOC	CP	CPI RE	CPI IM	MLOC	CP	CPI RE	CPI IM	MLOC	CP	CPI RE	CPI IM	MLOC	CP	CPI RE	CPI IM
.03	.555	.130	-4.519	.882	.674	-.245	2.910	.232	.566	.097	-4.544	.447	.679	-.263	8.541	-1.319
.10	.605	-.025	-2.821	.066	.624	-.084	3.380	.344	.616	-.059	-3.263	.095	.627	-.093	4.076	.615
.20	.627	-.096	-2.624	-.571	.616	-.059	2.347	.835	.638	-.130	-2.429	-.373	.619	-.069	2.778	1.033
.30	.636	-.122	-2.106	-.787	.622	-.078	2.134	1.324	.645	-.151	-1.945	-.770	.624	-.086	2.203	1.215
.40	.634	-.116	-1.393	-1.394	.631	-.107	1.524	1.601	.640	-.135	-1.502	-.933	.633	-.113	1.259	1.679
.50	.632	-.109	-1.032	-1.518	.630	-.103	1.122	1.431	.633	-.112	-1.228	-1.276	.631	-.108	1.125	1.405
.60	.629	-.100	-.988	-1.189	.626	-.091	.972	1.447	.630	-.104	-.684	-1.297	.628	-.096	.884	1.474
.70	.623	-.083	-.398	-1.268	.622	-.078	.510	1.329	.624	-.085	-.403	-1.252	.622	-.080	.381	1.585
.80	.609	-.036	-.061	-1.060	.607	-.031	.462	1.020	.609	-.037	-.246	-1.022	.607	-.031	.357	.844
.90	.590	.022	.236	-.856	.588	.028	.073	.811	.589	.024	.228	-.688	.587	.030	.013	.918

1

Table 6: Example of a database file (included in the database)

Remark: For files of the clean wing with any tip configuration, force and moment coefficients (which are blank in the above example) refer to values measured by the wing tip balance for that particular configuration.
For the different configurations tested, the steady normal force and pitching moment acting on the store were measured; the unsteady normal force and pitching moment were measured with the same balance. For test cases above 30 Hz doubts have been expressed concerning the store loads. For that reason all 40 Hz cases were omitted from the database files.

NATIONAL AEROSPACE LABORATORY NLR
NLR TR78030 U

RUN 383 10111977 NF-5 WING

TABLE 1.2

WINGSECTION 3

X/C	UPPERSIDE MLOC	CP	CPI RE	CPI IM	LOWERSIDE MLOC	CP	CPI RE	CPI IM
.03	.599	-.006	.002	-.047	.681	-.269	8.569	-1.276
.10	.616	-.061	-4.234	-.189	.627	-.096	5.190	.342
.20	.637	-.127	-3.121	-.705	.621	-.074	2.969	.679
.30	.644	-.149	-2.444	-.776	.625	-.087	2.370	1.205
.40	.640	-.136	-1.755	-1.098	.635	-.121	1.601	1.346
.50	.636	-.123	-1.140	-1.389	.632	-.109	1.432	1.331
.60	.632	-.109	-.876	-1.336	.628	-.099	.911	1.235
.70	.624	-.086	-.493	-1.111	.623	-.081	.660	.987
.80	.608	-.036	-.177	-.916	.606	-.029	.429	.958
.90	.590	.022	.002	-.702	.588	.029	.124	.673

WINGSECTION 4

X/C	UPPERSIDE MLOC	CP	CPI RE	CPI IM	LOWERSIDE MLOC	CP	CPI RE	CPI IM
.03	.573	.076	-5.379	.450	.681	-.268	8.299	-1.950
.10	.623	-.082	-3.592	-.064	.627	-.094	7.206	.280
.20	.644	-.150	-2.932	-.371	.622	-.079	3.354	.829
.30	.650	-.167	-2.259	-.773	.625	-.089	2.543	1.019
.40	.645	-.153	-1.972	-.951	.634	-.117	1.801	1.256
.50	.639	-.132	1.391	1.295	.632	-.111	1.239	1.290
.60	.630	-.106	-1.122	-.987	.628	-.098	1.008	1.239
.70	.625	-.087	-.597	-.987	.623	-.082	.494	1.077
.80	.610	-.040	-.180	-.854	.608	-.033	.272	.920
.90	.590	.023	.090	-.573	.588	.030	.091	.703

WINGSECTION 5

X/C	UPPERSIDE MLOC	CP	CPI RE	CPI IM	LOWERSIDE MLOC	CP	CPI RE	CPI IM
.03	.599	-.006	-.002	.045	.679	-.263	4.996	.311
.10	.623	-.082	-4.410	-.203	.629	-.100	5.360	.410
.20	.639	-.133	-3.141	-.683	.621	-.075	3.504	.804
.30	.649	-.164	-2.409	-.718	.626	-.093	2.614	1.015
.40	.644	-.150	-1.566	-.859	.635	-.121	1.903	1.304
.50	.637	-.127	-.974	-1.134	.632	-.112	1.338	1.240
.60	.633	-.113	-.849	-1.059	.629	-.100	.970	1.060
.70	.626	-.090	-.506	-.971	.623	-.080	.593	1.064
.80	.610	-.042	-.175	-.755	.607	-.031	.351	.882
.90	.589	.024	.112	-.486	.588	.030	.154	.496

WINGSECTION 6

X/C	UPPERSIDE MLOC	CP	CPI RE	CPI IM	LOWERSIDE MLOC	CP	CPI RE	CPI IM
.03	.586	.036	-6.548	-.064	.679	-.264	7.256	-.447
.10	.625	-.087	-1.961	-.392	.627	-.094	1.204	1.286
.20	.644	-.148	-3.539	-.646	.621	-.077	3.754	.786
.30	.649	-.166	-2.320	-1.192	.626	-.093	2.528	.887
.40	.645	-.153	-1.631	-.863	.635	-.120	1.477	1.063
.50	.637	-.127	-.915	-1.068	.633	-.112	1.132	1.010
.60	.632	-.111	-.640	-.860	.628	-.099	.878	1.024
.70	.626	-.090	-.389	-.841	.623	-.082	.418	.870
.80	.610	-.040	-.117	-.691	.607	-.031	.151	.630
.90	.589	.025	.109	-.426	.588	.029	.038	.461

WINGSECTION 7

X/C	UPPERSIDE MLOC	CP	CPI RE	CPI IM	LOWERSIDE MLOC	CP	CPI RE	CPI IM
.03	.578	.059	-7.403	-.409	.669	-.228	7.063	-.077
.10	.629	-.101	-3.428	-.453	.630	-.105	-2.076	1.054
.20	.645	-.151	-3.326	-.839	.621	-.075	3.891	.699
.30	.649	-.166	-2.069	-.730	.626	-.090	2.752	.786
.40	.646	-.155	-1.020	-.764	.636	-.122	1.656	.880
.50	.637	-.127	-.721	-.927	.633	-.112	1.133	.989
.60	.633	-.112	-.491	-.817	.628	-.099	.718	.871
.70	.625	-.087	-.260	-.751	.622	-.079	.392	.848
.80	.609	-.039	.052	-.587	.607	-.030	.174	.596
.90	.591	.020	.126	-.306	.588	.028	.050	.356

WINGSECTION 8

X/C	UPPERSIDE MLOC	CP	CPI RE	CPI IM	LOWERSIDE MLOC	CP	CPI RE	CPI IM
.03	.597	.000	-5.596	-.436	.665	-.227	6.286	.311
.10	.634	-.116	-3.036	-.297	.628	-.098	-3.654	.369
.20	.649	-.165	.384	-.501	.620	-.072	3.838	.741
.30	.647	-.159	2.200	-.827	.623	-.082	1.877	.647
.40	.640	-.135	2.005	-1.067	.629	-.100	1.095	.751
.50	.631	-.106	-.230	-.476	.627	-.096	.863	.738
.60	.627	-.094	-1.248	-.433	.624	-.086	.543	.627
.70	.622	-.078	-.317	-.522	.620	-.073	.088	.509
.80	.608	-.035	-.004	-.363	.605	-.026	.000	.452
.90	.589	.024	.075	-.174	.588	.028	-.085	.394

1

NATIONAL AEROSPACE LABORATORY NLR
NLR TR78030 U

RUN 383 10111977 NF-5 WING

TABLE 1.3

X/C	CP-KULILES RE	CP-KULILES IM
.10	-3.729	.365
.20	-2.546	-.509
.30	-2.146	-.713
.40	-1.533	-.973
.50	-.921	-1.098
.60	-.738	-1.188
.70	-.585	-.991
.80	-.397	-.851

1

Table 6 (continued): Example of a database file (included in the database)

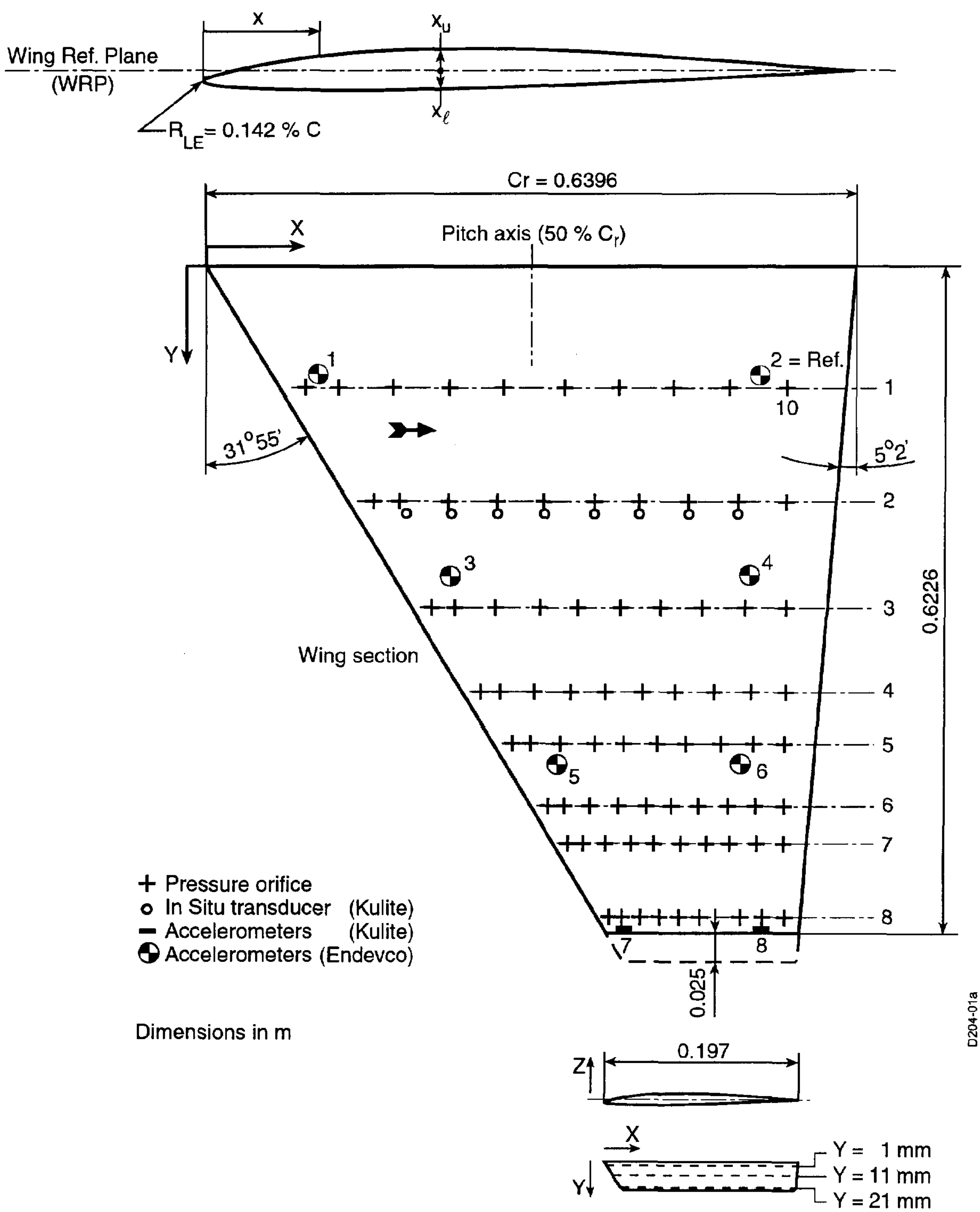


Figure 1: NLR F-5 clean wing, location of pressure orifices and transducers

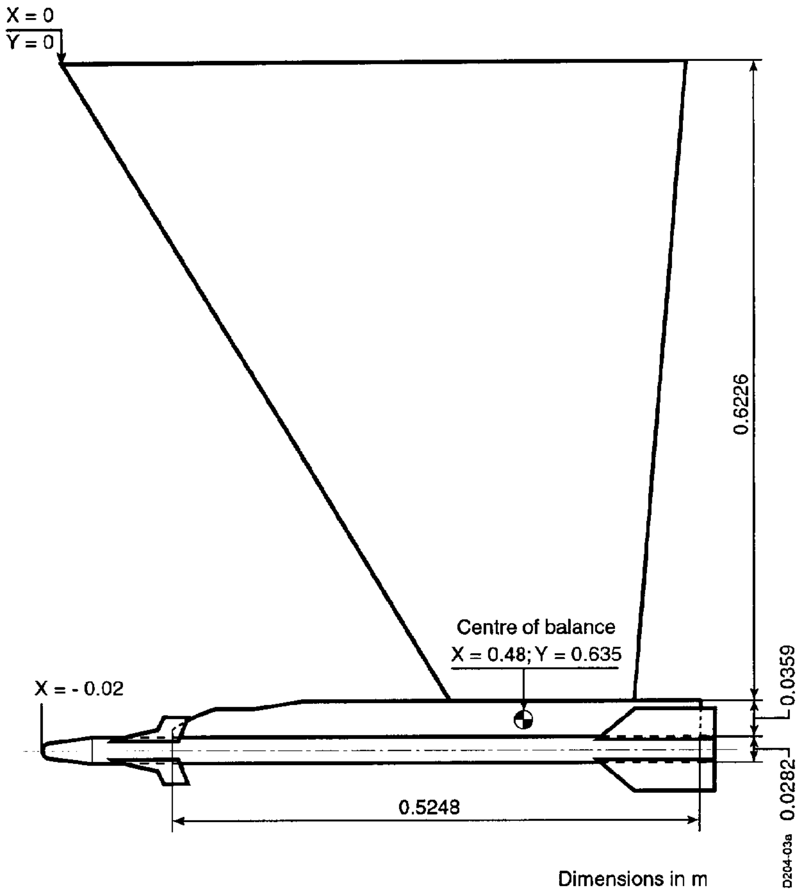


Figure 2a: Position of the store and strain gage balances

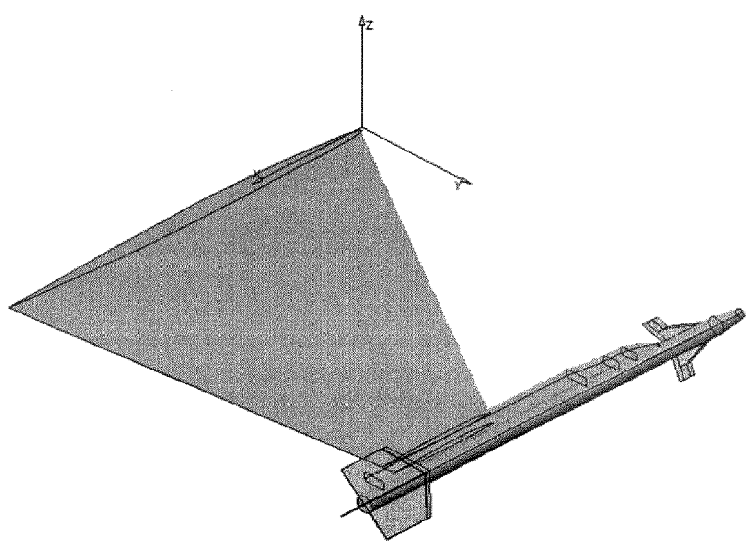


Figure 2b: CATIA example of F5 wing with tip store